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PATENT COOPERATION TREATY

PCT

NOTIFICATION CONCERNING
SUBMISSION OR TRANSMITTAL
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

From the INTERNATIONAL BUREAU

To:

BERGGREN OY AB
P.O. Box 16
FIN-00101 Helsinki
FINLANDE

SHL / ALB

Date of mailing (day/month/year) 04 August 1998 (04.08.98)	
Applicant's or agent's file reference 46547	IMPORTANT NOTIFICATION
International application No. PCT/FI98/00460	International filing date (day/month/year) 29 May 1998 (29.05.98)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 30 May 1997 (30.05.97)
Applicant NOKIA MOBILE PHONES LTD. et al	

1. The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
2. This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.
3. An asterisk(*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
4. The letters "NR" appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

<u>Priority date</u>	<u>Priority application No.</u>	<u>Country or regional Office or PCT receiving Office</u>	<u>Date of receipt of priority document</u>
30 May 1997 (30.05.97)	972299	FI	27 July 1998 (27.07.98)

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 740.14.35	Authorized officer A. Karkachi Telephone No. (41-22) 338.83.38
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PATENT COOPERATION TREATY

PCT

NOTIFICATION OF RECEIPT OF
RECORD COPY

(PCT Rule 24.2(a))

From the INTERNATIONAL BUREAU

To:

BERGGREN OY AB
P.O. Box 16
FIN-00101 Helsinki [0-97-111]
FINLANDE

MB/PKM

Date of mailing (day/month/year) 25 June 1998 (25.06.98)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference 46547	International application No. PCT/FI98/00460

The applicant is hereby notified that the International Bureau has received the record copy of the international application as detailed below.

Name(s) of the applicant(s) and State(s) for which they are applicants:

NOKIA MOBILE PHONES LTD. (for all designated States except US)
TOSKALA, Antti et al (for US)

International filing date : 29 May 1998 (29.05.98)

Priority date(s) claimed : 30 May 1997 (30.05.97)

Date of receipt of the record copy
by the International Bureau : 18 June 1998 (18.06.98)

List of designated Offices :

AP : GH, GM, KE, LS, MW, SD, SZ, UG, ZW

EA : AM, AZ, BY, KG, KZ, MD, RU, TJ, TM

EP : AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE

OA : BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG

National : AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW

ATTENTION

The applicant should carefully check the data appearing in this Notification. In case of any discrepancy between these data and the indications in the international application, the applicant should immediately inform the International Bureau.

In addition, the applicant's attention is drawn to the information contained in the Annex, relating to:

☒ time limits for entry into the national phase;

☐ confirmation of precautionary designations;

☒ requirements regarding priority documents.

A copy of this Notification is being sent to the receiving Office and to the International Searching Authority.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer:

Aino Metcalfe

Telephone No. (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

INFORMATION CONCERNING ELECTED
OFFICES NOTIFIED OF THEIR ELECTION

(PCT Rule 61.3)

From the INTERNATIONAL BUREAU

To:

BERGGREN OY AB
P.O. Box 16
FIN-00101 Helsinki
FINLANDE*Berggren Oy AB*

28 -01- 1999

rkem /MB

Date of mailing (day/month/year)

15 January 1999 (15.01.99)

Applicant's or agent's file reference

46547

IMPORTANT INFORMATION

International application No.

PCT/FI98/00460

International filing date (day/month/year)

29 May 1998 (29.05.98)

Priority date (day/month/year)

30 May 1997 (30.05.97)

Applicant

NOKIA MOBILE PHONES LTD. et al

1. The applicant is hereby informed that the International Bureau has, according to Article 31(7), notified each of the following Offices of its election:

AP : GH, GM, KE, LS, MW, SD, SZ, UG, ZW

EP : AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE

National : AU, BG, BR, CA, CN, CZ, DE, GB, IL, JP, KP, KR, MN, NO, NZ, PL, RO, RU, SE, SK, US,
VN

2. The following Offices have waived the requirement for the notification of their election; the notification will be sent to them by the International Bureau only upon their request:

EA : AM, AZ, BY, KG, KZ, MD, RU, TJ, TM

OA : BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG

National : AL, AM, AT, AZ, BA, BB, BY, CH, CU, DK, EE, ES, FI, GE, GH, GM, GW, HU, ID, IS, KE,
KG, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MW, MX, PT, SD, SG, SI, SL, TJ, TM, TR, TT, UA,
UG, UZ, YU, ZW

3. The applicant is reminded that he must enter the "national phase" before the expiration of 30 months from the priority date before each of the Offices listed above. This must be done by paying the national fee(s) and furnishing, if prescribed, a translation of the international application (Article 39(1)(a)), as well as, where applicable, by furnishing a translation of any annexes of the international preliminary examination report (Article 36(3)(b) and Rule 74.1).

Some offices have fixed time limits expiring later than the above-mentioned time limit. For detailed information about the applicable time limits and the acts to be performed upon entry into the national phase before a particular Office, see Volume II of the PCT Applicant's Guide.

The entry into the European regional phase is postponed until 31 months from the priority date for all States designated for the purposes of obtaining a European patent.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Authorized officer:

Lazar Joseph Panakal

Facsimile No. (41-22) 740.14.35

Telephone No. (41-22) 338.83.38

PCT

**NOTICE INFORMING THE APPLICANT OF THE
COMMUNICATION OF THE INTERNATIONAL
APPLICATION TO THE DESIGNATED OFFICES**

(PCT Rule 47.1(c), first sentence)

From the INTERNATIONAL BUREAU

To:
BERGGREN OY AB
P.O. Box 16
FIN-00101 Helsinki
FINLANDE

Signature
17-12-1998
Hm / MB

Date of mailing (day/month/year) 03 December 1998 (03.12.98)		
Applicant's or agent's file reference 46547		IMPORTANT NOTICE
International application No. PCT/FI98/00460	International filing date (day/month/year) 29 May 1998 (29.05.98)	Priority date (day/month/year) 30 May 1997 (30.05.97)
Applicant NOKIA MOBILE PHONES LTD. et al		

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
AU, BR, CA, CN, EP, IL, JP, KP, KR, PL, US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
AL, AM, AP, AT, AZ, BA, BB, BG, BY, CH, CU, CZ, DE, DK, EA, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IS, KE, KG, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, OA, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW
The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on 03 December 1998 (03.12.98) under No. WO 98/54849

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

<p style="text-align: center;">The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No. (41-22) 740.14.35</p>	<p>Authorized officer J. Zahra</p> <p>Telephone No. (41-22) 338.83.38</p>
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PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

Berggren OY AB
P.O. Box 16
FIN-00101 HELSINKI
Finland

14-05-1999

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WRITTEN OPINION

(PCT Rule 66)

Applicant's or agent's file reference 46547		Date of mailing (day/month/year) 11-05-1999
International application No. PCT/FI98/00460		REPLY DUE within 60 days from the above date of mailing 10.9.1999
International filing date (day/month/year) 29.05.1998	Priority date (day/month/year) 30.05.1997	
International Patent Classification (IPC) or both national classification and IPC ₆ H 04 B 7/08		
Applicant Nokia Mobile Phones Ltd. et al		

1. This written opinion is the first (first, etc.) drawn by this International Preliminary Examining Authority.
2. This opinion contains indications relating to the following items:
 - I ☒ Basis of the report
 - II ☐ Priority
 - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
 - IV ☐ Lack of unity of invention
 - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - VI ☐ Certain documents cited
 - VII ☐ Certain defects in the international application
 - VIII ☐ Certain observations on the international application
3. The applicant is hereby invited to reply to this opinion.

When? See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4bis.
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.
4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 30.09.1999

Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Bengt Romedahl Telephone No. 08-782 25 00
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WRITTEN OPINION

International application No.

PCT/FI98/00460

I Basis of the report

1. This opinion has been drawn on the basis of *(Substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed")*:

- ☒ the international application as originally filed.
- ☐ the description, pages _____, as originally filed,
 pages _____, filed with the demand,
 pages _____, filed with the letter of _____.
- ☐ the claims, Nos. _____, as originally filed,
 Nos. _____, as amended under Article 19,
 Nos. _____, filed with the demand,
 Nos. _____, filed with the letter of _____.
- ☐ the drawings, sheets/fig _____, as originally filed,
 sheets/fig _____, filed with the demand
 sheets/fig _____, filed with the letter of _____.

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/fig _____

3. ☐ This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:

WRITTEN OPINION

International application No.

PCT/FI98/00460

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-17</u>	YES
	Claims	_____	NO
Inventive step (IS)	Claims	<u>9-15</u>	YES
	Claims	<u>1-8, 16, 17</u>	NO
Industrial applicability (IA)	Claims	<u>1-17</u>	YES
	Claims	_____	NO

2. Citations and explanations

The claimed invention relates to a method, system and apparatus for diversity reception, where different reception branches are tuned to different frequencies and tuned simultaneously.

From US 5345602 A (column 3, line 31 - line 64; abstract) an apparatus for diversity reception is previously known, where alternative frequencies are tested on different reception branches simultaneously. This corresponds to what is claimed in claims 1, 2, 5, 8, 16 and 17.

Claims 3, 4, 6 and 7 only comprise further technical features obvious for a person skilled in the art.

JP 6-253074 A (patent abstract of Japan), WO 9430025 A1 (abstract), US 5101501 A (cited in the application) and WO 9709792 A1 (abstract) show the state of art.

According to the above stated arguments the invention claimed in claims 1 - 8, 16 and 17 is not considered to involve an inventive step.

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:

Berggren Oy Ab
P.O. Box 16
FIN-00101 HELSINKI
Finland

Berggren Oy Ab

28 -12- 1998

NOTIFICATION OF RECEIPT OF DEMAND BY COMPETENT INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

(PCT Rules 59.3(e) and 61.1(b), first sentence
and Administrative Instructions, Section 601(a))

Date of mailing
(day/month/year) 22 -12- 1998

Applicant's or agent's file reference
46547 / MB / TIK

IMPORTANT NOTIFICATION

International application No.
PCT/FI98/00460

International filing date (day/month/year)
29-05-1998

Priority date (day/month/year)
30-05-1997

Applicant
Nokia Mobile Phones Ltd.
et al

1. The applicant is hereby notified that this International Preliminary Examining Authority considers the following date as the date of receipt of the demand for international preliminary examination of the international application:

21-12-1998

2. This date of receipt is:

- ☒ the actual date of receipt of the demand by this Authority (Rule 61.1(b)).
- ☐ the actual date of receipt of the demand on behalf of this Authority (Rule 59.3(e)).
- ☐ the date on which this Authority has, in response to the invitation to correct defects in the demand (Form PCT/IPEA/404), received the required corrections.

3. ☐ **ATTENTION:** That date of receipt is **AFTER** the expiration of 19 months from the priority date. Consequently, the election(s) made in the demand does (do) not have the effect of postponing the entry into the national phase until 30 months from the priority date (or later in some Offices) (Article 39(1)). Therefore, the acts for entry into the national phase must be performed within 20 months from the priority date (or later in some Offices) (Article 22). For details, see the *PCT Applicant's Guide*, Volume II.

- ☐ (If applicable) This notification confirms the information given by telephone, facsimile transmission or in person on:

4. Only where paragraph 3 applies, a copy of this notification has been sent to the International Bureau.

Name and mailing address of the IPEA/
Patent- och registreringsverket
Box 5055
S-102 42 STOCKHOLM
Facsimile No. 08-667 72 88

Telex
17978
PATOREG-S

Authorized officer

Britt-Marie Little

Telephone No. 08-782 25 00

RECEIVED

17 SEPT. 1999

protector

U. B. Ryhlm

Applicant's or agent's file reference 46547	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/FI98/00460	International filing date (day/month/year) 29.05.1998	Priority date (day/month/year) 30.05.1997
International Patent Classification (IPC) or national classification and IPC ₆ H 04 B 7/08		
Applicant Nokia Mobile Phones Ltd. et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of <u>3</u> sheets, including this cover sheet.
<input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).
These annexes consist of a total of <u>4</u> sheets.
3. This report contains indications relating to the following items:
I <input checked="" type="checkbox"/> Basis of the report
II <input type="checkbox"/> Priority
III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV <input type="checkbox"/> Lack of unity of invention
V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI <input type="checkbox"/> Certain documents cited
VII <input type="checkbox"/> Certain defects in the international application
VIII <input type="checkbox"/> Certain observations on the international application

Date of submission of the demand 21.12.1998	Date of completion of this report 24.08.1999
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Bengt Romedahl/MN Telephone No. 08-782 25 00

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI98/00460

I. Basis of the report

1. This report has been drawn on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

- ☐ the international application as originally filed.
- ☒ the description, pages 1-14, as originally filed,
pages _____, filed with the demand,
pages _____, filed with the letter of _____,
pages _____, filed with the letter of _____.
- ☒ the claims, Nos. _____, as originally filed,
Nos. _____, as amended under Article 19,
Nos. _____, filed with the demand,
Nos. 1-16, filed with the letter of 30.06.99,
Nos. _____, filed with the letter of _____.
- ☒ the drawings, sheets/fig 1-8, as originally filed,
sheets/fig _____, filed with the demand
sheets/fig _____, filed with the letter of _____,
sheets/fig _____, filed with the letter of _____.

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/fig _____

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI98/00460

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims	<u>1-16</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-16</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-16</u>	YES
	Claims		NO

2. Citations and explanations

The invention claimed in the letter of June 30, 1999 relates to a method, system and apparatus for diversity reception, where different reception branches are tuned to different baseband frequencies and tuned simultaneously.

From US 5345602 A (column 3, line 31 - line 64; abstract) an apparatus for diversity reception is previously known, where alternative frequencies are tested on different reception branches simultaneously. What differs is that this test is made on intermediate frequencies and not baseband frequencies as in the invention claimed.

JP 6-253074 A (patent abstract of Japan), WO 9430025 A1 (abstract), US 5101501 A (cited in the application) and WO 9709792 A1 (abstract) show the state of art.

According to the above stated arguments the invention claimed in claims 1 - 16 is novel and considered to involve an inventive step and to comprise industrial applicability.

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 46547	FOR FURTHER ACTION <small>see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.</small>	
International application No. PCT/FI 98/00460	International filing date (<i>day/month/year</i>) 29 May 1998	(Earliest) Priority Date (<i>day/month/year</i>) 30 May 1997
Applicant Nokia Mobile Phones LTD. et al		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. ☐ Certain claims were found unsearchable (See Box I).
2. ☐ Unity of invention is lacking (See Box II).
3. ☐ The international application contains disclosure of a nucleotide and/or amino acid sequence listing and the international search was carried out on the basis of the sequence listing
 - ☐ filed with the international application.
 - ☐ furnished by the applicant separately from the international application,
 - ☐ but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.
 - ☐ transcribed by this Authority.
4. With regard to the title: ☒ the text is approved as submitted by the applicant.
☐ the text has been established by this Authority to read as follows:
5. With regard to the abstract,
 - ☒ the text is approved as submitted by the applicant.
 - ☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.
6. The figure of the drawings to be published with the abstract is:
 - Figure No. 1 ☒ as suggested by the applicant. ☐ None of the figures.
 - ☐ because the applicant failed to suggest a figure.
 - ☐ because this figure better characterizes the invention.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 98/00460

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04B 7/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5345602 A (KURT WIEDEMANN ET AL), 6 Sept 1994 (06.09.94), column 3, line 31 - line 64, abstract --	1-17
A	Patent Abstracts of Japan, abstract of JP 6-253074 A (JAPAN RADIO CO LTD), 9 Sept 1994 (09.09.94) --	1-17
A	WO 9430025 A1 (NOKIA TELECOMMUNICATIONS OY), 22 December 1994 (22.12.94), abstract --	1-17
A	US 5101501 A (KLEIN S. GILHOUSEN ET AL), 31 March 1992 (31.03.92), cited in the application --	1-17

☒ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

- * Special categories of cited documents:
- "A" document defining the general state of the art which is not considered to be of particular relevance
 - "E" earlier document but published on or after the international filing date
 - "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
 - "O" document referring to an oral disclosure, use, exhibition or other means
 - "P" document published prior to the international filing date but later than the priority date claimed
 - "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
 - "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
 - "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
 - "&" document member of the same patent family

Date of the actual completion of the international search

8 December 1998

Date of mailing of the international search report

09 -12- 1998

Name and mailing address of the ISA:

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INTERNATIONAL SEARCH REPORT

national application No.
PCT/FI 98/00460

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9709792 A1 (PREMIER WIRELESS, INC.), 13 March 1997 (13.03.97), abstract -----	1-17

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Information on patent family members

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Making measurements on parallel frequencies in a radio communications device

The invention relates in general to measurements by means of which a radio apparatus attempts to find out the quantity and quality of radio-frequency oscillation in its operating environment. In particular the invention relates to measurements
5 directed to frequencies other than that used for transmission and reception by a radio apparatus in a code division system during the measurements.

A communications link between a cellular radio system base station and terminal requires that the terminal transmits at a certain first frequency and receives at a
10 certain second frequency which may be the same as said first frequency if the transmission and reception are otherwise separated by means of a duplexing method. Optimal link quality requires that the terminal selects a base station with a strong signal, and a frequency with as little noise and interference as possible.

Cellular radio systems applying code division multiple access (CDMA) have so far
15 been mainly so-called single frequency networks (SFN) in which the whole system uses only one frequency band. This kind of an arrangement is used e.g. in the North-American IS-95 (Interim Standard 95) system. Frequency ranges used by other types of cellular radio systems are usually divided into several parallel frequency bands which can be called carrier wave frequencies or just frequencies in short.
20 Proposals for future cellular radio systems have also put forward systems based on code division multiple access which have several frequency bands e.g. to separate hierarchically arranged cells from each other. This requires that a system be developed with which a receiver in such a system can carry out measurements not only at the frequency used, but also at other frequencies in order to find out how
25 much there is other traffic and noise at the other frequencies.

A measurement means that the receiver in a terminal is tuned to the frequency measured and the required observations are made concerning the quantity and quality of the signal received, such as the mean power level at the frequency measured and its temporal distribution, for example. The receiver is tuned by
30 changing the mixing frequency brought to a mixer in the receiver. When the receiver is tuned to the frequency measured it naturally cannot simultaneously receive a signal at the communications frequency used. So, the measurement of parallel frequencies cannot be carried out coincidentally with the reception of the desired signal at the communications frequency used.

It is known from patent document US 5,101,501 some arrangements for realising a handover in a CDMA-type cellular radio system, applicable in single frequency networks. In an arrangement discussed by said document in conjunction with the description of the prior art, measurements are carried out not by the terminals but by the base stations. This arrangement requires that each base station has at all times free demodulating units that can be instructed to receive and measure a transmission by a terminal the signal of which in a neighbouring cell is weakening, thus indicating that the terminal is moving toward the inter-cell boundary. The transmission from the terminal is received, if necessary, by both base stations and the total responsibility for the connection is handed over to the new base station only when the terminal has clearly crossed the inter-cell boundary. In this method the base station equipment is continuously under-utilised since there has to be so many demodulating units that some of them are always free. Furthermore, the inter-base station signalling needed for the coordination of connections received via two routes puts a heavy load on the base station systems and their mutual communications connections.

Said patent document also discloses an improved arrangement in which the terminals measure a so-called pilot channel transmitted by the base stations. The implementation of the measurement is in practice rather simple as all base stations transmit at the same frequency. A terminal need not tune its receiver separately to other frequencies for measurement. It is obvious that this arrangement does not work if the different base stations transmit at different frequencies.

A known proposal for the arrangement of reception and measurement timing in a multifrequency CDMA system is a so-called compressed mode in which base station transmissions comprise successive frames in the normal manner but in which certain frames are transmitted at double speed so that half of the time reserved for such frames is left free for the measurements.

The proposed compressed mode involves several problems. The terminals have to be capable of receiving at a speed two times higher than the normal reception speed, which makes their structure and operation more complex. Compressing the frames means compromises in the implementation of control functions such as transmission power adjustment, which degrades the performance of the whole system. Pauses in the reception result in more complex continuous-operation algorithms, such as the measurement of propagation delay and channel estimation. Operation control for the compressed mode increases the signalling between the base stations and terminals.

In addition, the compressed mode is bound to cause deterioration of the bit error ratio, which is reflected in a decrease in the system performance.

5 An object of the present invention is to provide a method and equipment with which a terminal in a multifrequency, continuous-transmission radio communications system can make measurements not only at the operating frequency but also at other frequencies without the disadvantages characteristic of the prior art.

The objects of the invention are achieved by using in the terminal a diversity receiver and by switching one receiver branch at times to measurement use so that during measurement, the other branches of the receiver are receiving normally.

10 The radio apparatus according to the invention which comprises reception branches, a RAKE receiver including correlator branches, and a measuring receiver, is characterised in that it is arranged so as to tune a first reception branch to a different frequency than a second reception branch and to make measurements on both the signal generated by the first reception branch and the signal generated by the second
15 reception branch.

The invention is also directed to a method for implementing the measurements. The method according to the invention is characterised in that in order to make measurements at other than the operating frequency, at least one reception branch is tuned to other than the operating frequency and the signal received by it is taken to a
20 measuring receiver. A second embodiment of the method according to the invention is characterised in that in order to make measurements at other than the operating frequency, an impulse response measurement performed at the operating frequency by a measuring block in the RAKE receiver is interrupted and a measurement is carried out by the measuring block at other than the operating frequency.

25 The invention is further directed to a communications systems characterised in that at least one terminal in it is arranged so as to tune a first reception branch in the terminal to a different frequency than a second reception branch in the terminal and to make measurements on both the signal generated by the first reception branch and the signal generated by the second reception branch.

30 The diversity receiver as such is a known apparatus having at least two separate antennas and, related to them, at least two reception branches. Diversity reception is based on the fact that the reception characteristics of a radio apparatus depend to a large extent on the location, orientation and type of the receiving antenna. When a receiver has at least two antennas, the signals received through them can be

combined, thus producing a better reception result than by either of the antennas alone. The antennas may be located in the receiver e.g. in such a manner that they receive at different polarisations so that in the optimal case the power level of the combined signal is about 3 to 4 decibels higher than the power level received
5 through either of the antennas alone.

In the radio apparatus according to the invention, one branch of the diversity receiver includes a switch with which a signal received through that branch can be directed periodically to a measurement circuit. During measurement, the branch in question does not contribute to the combined signal, whereby the power level of the
10 received signal decreases, which degrades the quality of the received, demodulated and decoded signal (in a digital receiver, the degradation of quality means that the bit error ratio of the received, demodulated and decoded signal increases). The phenomenon can be compensated for e.g. by requesting, by means of known signalling related to power level control, the base station to transmit at higher power
15 during measurements. The base station may also automatically increase its power level for the duration of measurement periods if it can control the measurement timing used by the terminals or deduce it from the control messages it has sent. If the base station uses transmission interleaving the period of which is longer than a measurement period in the terminal, the interleaving, too, can be used to
20 compensate for the bit error ratio fluctuation caused by the measurements.

In accordance with the invention, a terminal applying code division multiple access can make measurements at other frequencies than the reception frequency in use without having to interrupt its other operation. The RF parts of the terminal are well utilised and the invention hardly adds to the complexity of the terminal.

25 The invention is described in more detail with reference to the preferred embodiments presented by way of example and to the accompanying drawing wherein

Fig. 1a illustrates the principle of the invention,
Fig. 1b shows a detail of Fig. 1a,
Fig. 2 shows a diversity receiver in a radio apparatus according to the invention,
30 Fig. 3 shows a variation of the structure shown in Fig. 2,
Fig. 4 shows a second variation of the structure shown in Fig. 2,
Figs. 5a and 5b show alternative arrangements for producing mixing frequencies,
Fig. 6 shows the locations of parts of the diversity receiver according to Fig. 2 or 3 in a terminal of a cellular radio system,
35 Fig. 7 shows an embodiment of the method according to the invention, and

Fig. 8 shows a communications system according to the invention.

Like elements in the Figures are denoted by like reference designators.

In Fig. 1a, line 10 represents a signal coming from a first antenna (not shown) of a diversity receiver, and line 11 represents a signal coming from a second antenna (not shown) of the diversity receiver. Parallel RF and IF blocks 12 and 13 comprise the necessary elements for filtering, amplifying and converting the incoming RF signal into a baseband signal. Block 14 is a known RAKE receiver which combines the arriving nonsimultaneous, out-of-phase signals in a manner that produces a combined signal power as high as possible. A switch 15 has two positions. In the position 15a depicted by a dashed line the switch 15 couples the signal produced by the RF and IF block 13 to the RAKE receiver's 14 second input which is similar to the input to which the signal produced by the RF and IF block 12 is coupled directly. In the position 15b depicted as a continuous line the switch 15 couples the signal produced by the RF and IF block 13 to a measuring receiver 16 which measures the power level of the signal brought to it as well as the temporal distribution of power and, if necessary, other factors that the terminal needs to know in order to be able to make the decision on frequency selection. Measuring receivers as such are known from prior-art devices that use e.g. the compressed mode to make measurements.

For simplicity, Fig. 1a does not show the path of the signal from the RAKE receiver 14 and measuring receiver 16 on, but it is obvious to a person skilled in the art that after the receiver the signal can be taken to many kinds of circuits and devices for further processing. If the received signal is a representation of speech, as in a telephone, it is converted to acoustic form by means of a loudspeaker and appropriate peripheral circuits. If the signal comprises data, it can be taken to a computer processor for processing or to a memory device for storage. The invention does not specify the nature or amount of information transferred via the communications connection, nor its use after reception.

Fig. 1b shows in more detail the structure of the RAKE receiver 14. Parallel blocks 14a, 14b, 14c and 14d are so-called RAKE fingers, or correlator branches, which are synchronised to received signal components. Block 14e is a measuring block for measuring the impulse response of the received signal, the measurement results of which are used for controlling the operation of the correlator branches 14a to 14d. The signals produced by the different correlator branches are combined and demodulated in block 14f from which the combined signal is taken to the other parts

of the radio apparatus. In the arrangement according to the invention, the measuring block 14e measures the impulse response from both (all, if there are more than two antennas) branches of the diversity receiver and synchronises the correlator branches 14a to 14d to the signal components with the highest received power levels e.g. in the order according to the measured impulse response strength. The measuring block 14e and correlator branches 14a to 14d include a logic switch or other switch arrangement which is not shown in Fig. 1b and with which the measuring block 14e and each correlator branch 14a can be coupled to receive the signal produced by either of the branches of the diversity receiver. After correlation, the received signal components are combined in block 14f regardless of the diversity branch through which a particular signal component was received. When a switch 15 according to Fig. 1a directs signals received by a second branch of the diversity receiver to measurement, only signal components received by the first branch of the diversity receiver are directed to the correlator branches 14a to 14d in the RAKE receiver 14.

A broadband signal at the measured frequency is brought to the measuring receiver during the measurement. The measuring receiver knows the spreading codes used by the base stations measured and uses them to calculate the strength and quality of the measured signal in a known manner either by correlating the code with the received signal or by using a matched filter. The operation of the measuring receiver 16 resembles the operation of the measuring block 14e of the RAKE receiver 14. Indeed, in an embodiment of the invention, the measuring receiver of the RAKE receiver can be used to carry out the measurements at other frequencies, instead of using a separate measuring receiver. Then the measurement of the impulse response at the frequency in use naturally has to be interrupted for the duration of the measurements at other frequencies. By means of a switch arrangement (not shown) in the measuring block the measuring block is coupled so as to receive a signal produced by that branch of the diversity receiver which is tuned to the frequency measured, and by means of switch arrangements (not shown) in the correlator branches the correlator branches are coupled so as to receive only the signal produced by that branch of the diversity receiver which stays tuned to the frequency in use.

Fig. 2 shows a more detailed implementation to realise the principle according to Fig. 1a. Lines 10 and 11 represent signals coming from a first and second antenna (not shown). A RF and IF block 12 includes a duplex filter 20 having an input line 21 from the transmitter modulator (not shown) of the radio apparatus and an output

line 22 to the first antenna of the radio apparatus for transmitting radio signals. In practice, the signals represented by lines 10 and 22 travel through a common micro-strip conductor and/or coaxial cable between the duplex filter 20 and the first antenna of the radio apparatus. The duplex filter 20 directs the transmitted and received signals in such a manner that the transmission-frequency signal from the modulator is taken to the antenna and the reception-frequency signal from the antenna is taken to a filter and amplifier block 23. The filtered and amplified signal is taken to a down-conversion block 24 where it is converted to an intermediate frequency (IF) and further to an IF filtering and baseband conversion block 25 where the IF signal is filtered and converted to baseband. The resulting signal is taken to a first input of the RAKE receiver 14. The entity comprising blocks 20, 23, 24 and 25 can be called a first reception branch of the diversity receiver of the radio apparatus.

In Fig. 2, a RF and IF block 13 comprises a filter and amplifier block 26, down-conversion block 27 and an IF filtering and baseband conversion block 28, which are similar to the aforementioned blocks 23, 24 and 25. A signal represented by line 11 is taken through the blocks 26, 27 and 28 in this order. A switch or divider block 15 after block 28 comprises an electrically-controlled switch or divider (not shown) which may be e.g. a known semiconductor switch. A control signal brought to block 15 via a control line 29 determines whether the signal produced by a second reception branch comprising blocks 26, 27 and 28 is taken from block 15 to a second input of the RAKE receiver 14 or to a measuring receiver 16.

The switch that directs the signal produced by the second reception branch either to the reception or to the measurement need not be located just before the RAKE receiver. Fig. 3 shows a variation of the implementation shown in Fig. 2. The first branch of the receiver is similar to that of Fig. 2, but the RF and IF block 30 of the second branch comprises a RF switch 31 located between a filter and amplifier block 26 and two parallel down-conversion blocks 32 and 33. A control signal brought to the switch 31 via a control line 29 determines whether the signal filtered and amplified in block 26 is taken to block 32 or to block 33. A signal taken to block 32 is IF converted and taken further via an IF filtering and baseband conversion block 34 to the RAKE receiver 14, but a signal taken to block 33 is IF converted and taken via an IF filtering and baseband conversion block 35 to a measuring receiver 16.

In the embodiment of Fig. 3, two parallel and mutually independent IF conversion blocks make it possible to change very rapidly the operation of the second reception

branch from the operating frequency to the frequency measured and vice versa. The first IF conversion block 32 may stay tuned to the operating frequency all the time and the second IF conversion block 33 may be tuned in advance to the frequency measured so that in the beginning and end of the measurement there is no need to use time for tuning the IF conversion as in the embodiment shown in Fig. 2.

In Figs. 2 and 3, coupling to the measuring receiver is arranged from the branch of the diversity receiver that has no duplex filter. This is advantageous because then there is no need to concern about the changing of the duplex interval, or the frequency difference between the transmission and reception frequencies during measurements.

Fig. 4 shows an embodiment of the structure according to the invention wherein both branches 12 and 13 of the diversity receiver are in continuous connection with a RAKE receiver 14' and wherein a control line 29 couples by means of switch means in the measuring block of the RAKE receiver 14' the measuring block so as to measure a signal generated by one or the other of the diversity branches. When the measurement is directed to other than the operating frequency, the switches in the RAKE receiver's correlator branches direct to the correlator branches only the signal produced by the lower diversity branch 12; the upper diversity branch 13 is tuned to the frequency measured and the signal produced by the upper diversity branch 13 is taken to the RAKE receiver's measuring block by means of switch means included in it.

The IF conversion requires that the received signal be mixed with a desired mixing-frequency signal. Figs. 5a and 5b show two alternative principles for producing the required mixing frequencies. Each of the IF conversion blocks 42 and 43 included in the reception branches 40 and 41 of the diversity receiver may have its own electrically controlled oscillator 44 and 45 in accordance with Fig. 5a or a mixing frequency signal of a desired frequency may be brought to the IF conversions blocks 42 and 43 from a common oscillator 46 via suitable electrically regulated frequency conversion circuits 47 and 48 in accordance with Fig. 5b. Generation of several desired frequencies from a common oscillator is known e.g. from the Finnish patent application FI 964559 which has the same applicant as this patent application. Furthermore, the generation of a suitable mixing frequency is known from all radio apparatuses that are tuned by changing the mixing frequency.

Fig. 6 schematically shows a mobile phone 50, which is a typical cellular radio system terminal. It comprises parts typical of prior-art mobile communications

devices, such as a microphone 51, keypad 52, display 53, earphone 54, and a control block 55 that controls the operation of the terminal. The control block 55 can be typically realised using a microcontroller unit (MCU) or digital signal processor (DSP) which has access to a memory 56. In addition, Fig. 6 shows a transmission block 57 which comprises speech encoding, channel encoding, scrambling and modulation as well as the transmission RF functions. A duplex filter 20, first antenna 58, second antenna 59, RF and IF block 12 in a first transmission branch, RF and IF block 13 in a second transmission branch, RAKE receiver 14, switch 15 and a measuring receiver 16 are located with respect to each other as in the above-described embodiment illustrated by Fig. 2. Fig. 6 assumes that the RAKE receiver 14 comprises in addition to the combining of signals coming from blocks 12 and 15, also the demodulation, descrambling, channel decoding and speech decoding for the combined signal so that the signal produced by the RAKE receiver 14 can be taken directly to the earphone 54. The control block 55 controls the tuning of the RF and IF blocks 12 and 13 as well as the operation of the switch 15 and the RAKE receiver 14. It receives measuring data from a measuring amplifier 16. In addition, the control block 55 controls the user interface of the mobile phone 50.

Below it will be discussed the implementation of the method according to the invention in a cellular radio system terminal with reference to a preferred embodiment illustrated in the form of a flow diagram in Fig. 7. Measurement activity according to the flow diagram can be commenced in any other stage of the operation of the cellular radio system in which it is receiving in the normal manner through at least two diversity reception branches a transmission sent by a base station. Therefore, Fig. 7 does not specify the state from which the downward-pointing arrow coming to state 60 originates. In state 60 the terminal decides whether it is going to make measurements at other than the operating frequency during the next frame. Here it is assumed that the measurements are timed in frames; various timing alternatives are discussed in more detail later on. If the terminal decides not to make measurements during the next frame, it receives the next frame normally in state 61 and returns to state 60. If the decision in state 60 is yes, the terminal moves from state 60 to state 62.

Taking one diversity reception branch from normal reception use to measurement use decreases the power level of the combined signal produced by the terminal's RAKE receiver by about 3 to 4 dB. To keep the bit error ratio of the received signal from deteriorating the terminal requests in state 62 the base station to transmit the next frame at a transmission power higher than the usual. It is known from the prior

art several methods to control the transmission power in a cellular radio system such that it is high enough to facilitate reasonably error-free reception, but at the same time as low as possible to prevent unnecessary use of power and to keep the general radio noise level from increasing too much. Controlling the transmission power
5 generally requires certain power control (PC) signalling between the terminals and base stations, so the request made in state 62 in Fig. 7 can be realised by means of known PC signalling and thus it does not increase the total amount of signalling needed in the system.

A method for controlling transmission power, in which method the receiving device
10 transmits to the transmitting device requests for increasing or decreasing the transmission power, is generally known as closed-loop power control. Every closed-loop power control scheme involves a delay between the moment when the need for changing the transmission power is perceived at the receiving device and the moment when the first transmission with the changed transmission power arrives
15 from the transmitting device to the receiving device. The delay arises from signal processing at the receiving device, waiting for a suitable moment to transmit the request for changing power, propagation delay between the receiving device and the transmitting device, signal processing at the transmitting device, waiting for the moment of next transmission to the particular receiving device that requested for the
20 power change, and propagation delay between the transmitting device and the receiving device. In a cellular radio system it is possible to estimate the length of the delay at any given moment. In fact, delay estimates are commonly used in the terminals and/or base stations of a cellular radio system to compensate for the momentary value of propagation delay between the base station and the terminal,
25 which value depends on the mutual distance therebetween and the possible effect of multipath propagation.

The delay estimate may be advantageously used together with the invention so that when the terminal knows that it will shortly take one diversity reception branch from normal reception use to measurement use, it starts transmitting to the base
30 station requests for an increase in the transmission power not later than one delay length before the start of the measurement. In an ideal situation the terminal transmits the request for an increase in the transmission power so that the first transmission transmitted with at an increased power level arrives at the terminal simultaneously with the beginning of the measurement. This way the higher
35 transmission power and the resulting prevention of bit error ratio from increasing will be available already when the measurement begins. Similary when the terminal

knows that it will shortly reconstitute the diversity reception branch from measurement use to normal reception use, it will start sending the requests for decreasing transmission power to the base station about one delay length beforehand. This way the base station avoids transmitting with an unnecessarily high power level for a short period around the end of the measurement, which is advantageous when the system interference level is considered.

In state 63 the terminal tunes the IF converter in the diversity reception branch used for measurements in such a manner that the measurement can be directed to the desired frequency. In state 64 the terminal sets a special switch (reference designator 15 in Figs. 1, 2 and 4, reference designator 31 in Fig. 3) in a position in which it takes the received signal to a measuring receiver. The measurement proper and the saving of the results in the terminal's memory take place in state 65. In state 66 the terminal decides whether it will continue measuring or whether it will return during the next received frame to normal reception. If the terminal decides to continue measuring, it returns to state 63 representing the tuning of the measuring branch. Otherwise, the terminal requests in state 67 the base station to reset the transmission power back to normal and sets in state 68 the aforementioned switch in a position in which it takes the received signal to the RAKE receiver and returns to state 60.

One measurement may last several frames, one whole frame or part of a frame. Timing can be based on a timetable used commonly in the system or each terminal can independently decide on the timing of the measurements it makes. If a measurement lasts only part of a frame at a time, with the length of said part of a frame being considerably shorter than the interleaving length used by the base station, the decrease of power level caused by the measurement in the terminal's RAKE receiver does not necessarily call for an increase in the transmission power of the base station because with the interleaved signal it is possible to correct the bit errors caused by the decrease in the power level. Separate requests for increasing and decreasing the base station transmission level are unnecessary if the measurements are performed exactly according to a certain timetable agreed upon in advance or signalled by the base station to the terminals each time. Namely, if the measurement timetable is known to the base station, it can increase and decrease the transmission power without separate requests from terminals. Timetables for the different terminals or groups of terminals are advantageously different so that the drop in the system performance is distributed evenly on the time axis and will not result in concentrated noise peaks. The length of measuring periods may also vary

according to whether the terminal is in the middle of a handover or has just performed a handover. When the terminal has not yet performed a handover, it may be preferable that it makes short "monitoring measurements" to mainly examine the signal strength in possible new cells. As a handover is being performed or has just been performed, it is preferable for the terminal to carry out a longer measurement in which it may receive control information such as the broadcast control channel (BCCH) from the new base station.

An advantageous further embodiment of the method according to the invention is a method where each terminal may adaptively change the rate at which it makes measurements. Previously it was stated that the invention makes it possible for each terminal to independently decide on the timing of the measurements it makes. Adaptive changing the rate of measurements means that if the terminal has not detected any other carriers during a completed inter-frequency measurement, it may reduce the rate of inter-frequency measurements to a relatively low value like 1 Hz or lower. On the other hand, if the terminal detects other carriers, it may keep the current rate of measurements or even increase it to a relatively high value like 20 Hz or higher. Also, it is advantageous to increase the rate of inter-frequency measurements when the relative received power (proportional to the perch/synchronization channel of the serving base station) from some or several other carriers increases. The stronger the other carriers, the more often should measurements be done because inter-frequency handovers are more likely to take place.

Any timing, adaptive or not, may be applied separately to different carriers, i.e. each carrier that could be measured may have its own measurement rate.

Next it will be discussed a communications system according to the invention with reference to a preferred embodiment illustrated in Fig. 8. The communications system 70 comprises in this case base stations (BS) 71 which are intended for mobile outdoor terminals and the coverage areas, or cells, or which are relatively large; the cell diameter is typically from a few hundred metres to a few kilometres. In addition, the communications system comprises local base stations (LBS) 72 which are located e.g. in office buildings and the coverage areas of which cover a room, a few rooms or a whole office. Operation of local base stations is controlled by a local base station controller (LBSC) 73 which, in turn, operates under a base station controller (BSC) 74, like the base stations 71. The base station controller 74 is connected with a mobile services switching centre (MSC) 75 which can have several base station controllers under it and which may be further connected to other

communications networks such as a public switched telephone network (PSTN). The terminals 76 are in radio connection with either the base stations 71 or local base stations 72, depending on the location of a particular terminal with respect to the base stations and on other factors affecting base station selection, which as such
5 are of no importance as far as this invention is concerned.

In the system according to Fig. 8, local base stations 72 can operate at a different frequency than the base stations 71. Then a terminal which is in radio connection with a base station 71 can in the manner according to the invention regularly measure the signal of the nearest local base station 72. Due to the smaller coverage
10 area of the local base stations and more stable indoor propagation conditions the local base stations 72 can generally offer to the terminals 76 a higher transmission rate or otherwise better service level so that it is advantageous for the terminals to try to switch from base station 71 cells to local base station 72 cells. To make measurements in the manner according to the invention the terminals 76 have a
15 diversity receiver 77 according to the invention the details of which were described earlier in this document. It should be noted that the invention does not require that all terminals of the communications system 70 include a diversity receiver according to the invention. In addition to the operating frequency, simpler terminals can make measurements also at other frequencies e.g. by skipping a frame once in a
20 while and using that time to make measurements. So, the invention does not exclude the use of old terminals, for example, which is a great benefit since the introduction of the system according to the invention might otherwise suffer from the unwillingness of users to purchase new terminals.

The base station controller 74 can control the operation of base stations and local
25 base stations e.g. in such a manner that it lets each base station or local base station know what other frequencies are probably receivable within the coverage area of each particular base station or local base station. The base stations and local base stations can forward this information to the terminals so that these can direct their measurements on the appropriate frequencies. If the system employs precise
30 timetables for the measurements by terminals, the base station controller 74 can coordinate those timetables e.g. such that in overlapping cells the measurements are made simultaneously so that the increase in the transmission power possibly required by the measurements is realised simultaneously in the base stations of the overlapping cells and the overall disturbance in the operation of the system remains
35 as small as possible.

5 It is obvious to a person skilled in the art that the preferred embodiments described above are exemplary only and do not limit the invention. For example, above it was discussed only diversity receivers having two reception branches. A diversity receiver can be easily constructed that has more reception branches, of which at least one comprises a switch by means of which the signal received by that branch can be directed to measurement instead of normal reception.

Claims

1. A radio apparatus (50) comprising a diversity receiver which has
- a first reception branch (12; 40) and a second reception branch (13; 41),
- a RAKE receiver (14) comprising correlator branches (14a, 14b, 14c, 14d) for
5 combining received signal components, and
- a measuring receiver (14e; 16) for making measurements,
characterised in that it is arranged so as to tune the first reception branch (12; 40)
to a different frequency than the second reception branch (13; 41) and to make
measurements of a signal produced by one reception branch simultaneously with the
10 reception of a signal produced by the other reception branch.
2. The radio apparatus of claim 1, **characterised** in that it comprises in a
reception branch a switch (15; 31) which has at least two states (15a, 15b) in the
first of which the switch is arranged so as to direct the signal received by said
15 reception branch to said RAKE receiver (14) and in the second of which the switch
is arranged so as to direct the signal received by said reception branch to said
measuring receiver (14e; 16).
3. The radio apparatus of claim 2, **characterised** in that said reception branch
20 comprises successively in the direction of the flow of the received signal
- an RF filter and amplifier (26),
- a first mixer (27) for IF conversion,
- an IF filter, and
- a second mixer (28) for baseband conversion,
25 so that said switch (15) is located after said second mixer in the direction of the flow
of the received signal.
4. The radio apparatus of claim 2, **characterised** in that said reception branch
comprises
30 - an RF filter and amplifier (26),
- a first mixer (32) for IF conversion,
- a first IF filter (34),
- a second mixer (34) for baseband conversion,
- a third mixer (33) for IF conversion,
35 - a second IF filter (35), and
- a fourth mixer (35) for baseband conversion,

so that said switch (31) is located between said RF filter and amplifier (26) on the one hand and said first mixer (32) and third mixer (33) on the other, and it is arranged so as to

- in a first state to conduct a signal from said RF filter and amplifier (26) via said first mixer (32), first IF filter (34) and second mixer (34) to said RAKE receiver (14) and
- in a second state to conduct a signal from said RF filter and amplifier (26) via said third mixer (33), second IF filter (35) and fourth mixer (35) to said measuring receiver (16).

10

5. The radio apparatus of claim 1, **characterised** in that it comprises an oscillator (44, 45) for each reception branch (40, 41) to produce the IF mixing frequency needed for the tuning of the reception branch.

15

6. The radio apparatus of claim 1, **characterised** in that it comprises a common oscillator (46) to produce the IF mixing frequencies needed for tuning all the reception branches as well as frequency conversion means (47, 48) to convert in each reception branch the frequency produced by said common oscillator to an IF mixing frequency suitable for tuning.

20

7. The radio apparatus of claim 1, **characterised** in that said RAKE receiver comprises a measuring block (14e) for measuring the impulse response of the received signals, and said measuring block can be repeatedly set so as to measure alternatively the signal produced by the first reception branch or the signal produced by the second reception branch.

25

8. A method for making frequency specific measurements in a diversity receiver which comprises at least two reception branches and which receives at a certain operating frequency, **characterised** in that to make measurements at other than the operating frequency, at least one reception branch is tuned (63) to other than the operating frequency and the signal received by it is directed (64) to a measuring receiver.

30

9. The method of claim 8, **characterised** in that a transmitter apparatus transmitting at the operating frequency is also requested (62) to transmit at a higher power during the time that at least one branch of the diversity receiver is tuned to other than the operating frequency.

35

10. The method of claim 9, **characterised** in that a request for transmitting at a higher power is transmitted to said transmitter apparatus at a moment of time which is earlier by a certain delay length than the commencement of making the measurements at other than the operating frequency, said delay length
5 corresponding to the previously estimated delay between a transmitted request for changing transmission power and the arrival at the receiver of the first transmission with the transmission power changed as per the request.
11. The method of claim 9, **characterised** in that a request for transmitting at a
10 lower power is transmitted to said transmitter apparatus at a moment of time which is earlier by a certain delay length than the end of making the measurements at other than the operating frequency, said delay length corresponding to the previously estimated delay between a transmitted request for changing transmission power and the arrival at the receiver of the first transmission with the transmission power
15 changed as per the request.
12. The method of claim 8, **characterised** in that the tuning of at least one branch of the diversity receiver to other than the operating frequency is timed according to a certain predetermined timetable which is known to the transmitter apparatus
20 transmitting at the operating frequency.
13. The method of claim 12, **characterised** in that said transmitter apparatus has various timetables concerning various terminals or groups of terminals.
- 25 14. The method of claim 8, **characterised** in that bit errors that occur in the reception while at least one branch of the diversity receiver is tuned to other than the operating frequency are corrected using interleaving in the signal received at the operating frequency.
- 30 15. The method of claim 8, **characterised** in that the tuning of at least one branch of the diversity receiver to other than the operating frequency is timed according to a timetable determined by the diversity receiver, the interval in the timetable between consecutive tunings of at least one branch of the diversity receiver to other than the operating frequency being inversely proportional to the relative received
35 power, proportional to the received power at the operating frequency, on some or several other carriers.

16. A method for making frequency specific measurements in a diversity receiver which comprises at least two reception branches and a RAKE receiver including correlator branches and which receives at a certain operating frequency, **characterised** in that to make measurements at other than the operating frequency, an impulse response measurement at the operating frequency carried out by a measuring block in the RAKE receiver is interrupted and said measuring block is set to carry out a measurement at other than the operating frequency.
17. A communications system (70) comprising base stations (71, 72) and terminals (76) of which at least one comprises a diversity receiver (77) which has at least two reception branches and a RAKE receiver including correlator branches to combine signals received by the different reception branches and which also has a measuring receiver to make measurements, **characterised** in that at least one terminal is arranged so as to tune the first reception branch (12; 40) to other frequencies than the second reception branch (13; 41) and to make measurements of both the signal produced by the first reception branch and the signal produced by the second reception branch.

1 / 8

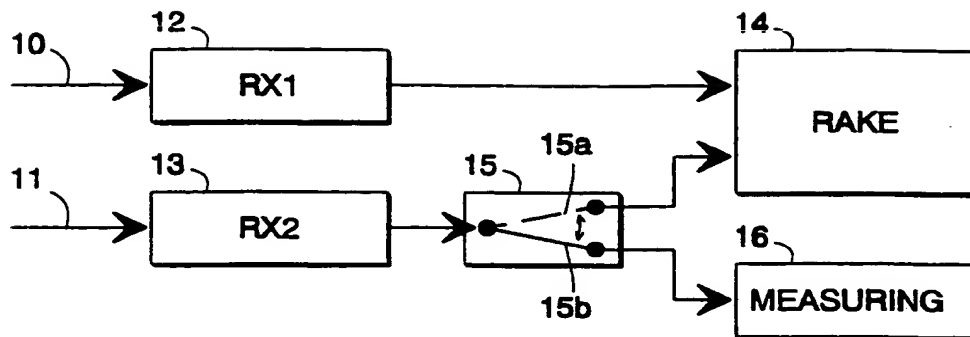


Fig. 1a

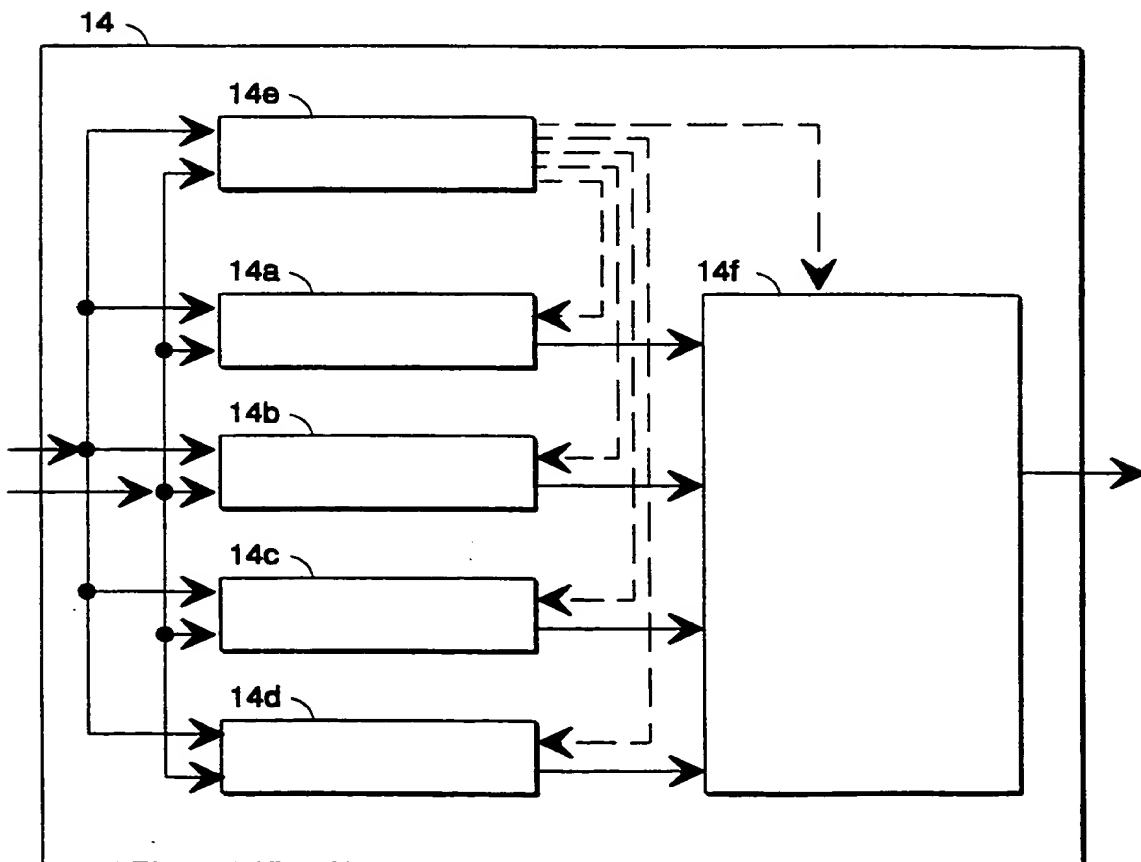


Fig. 1b

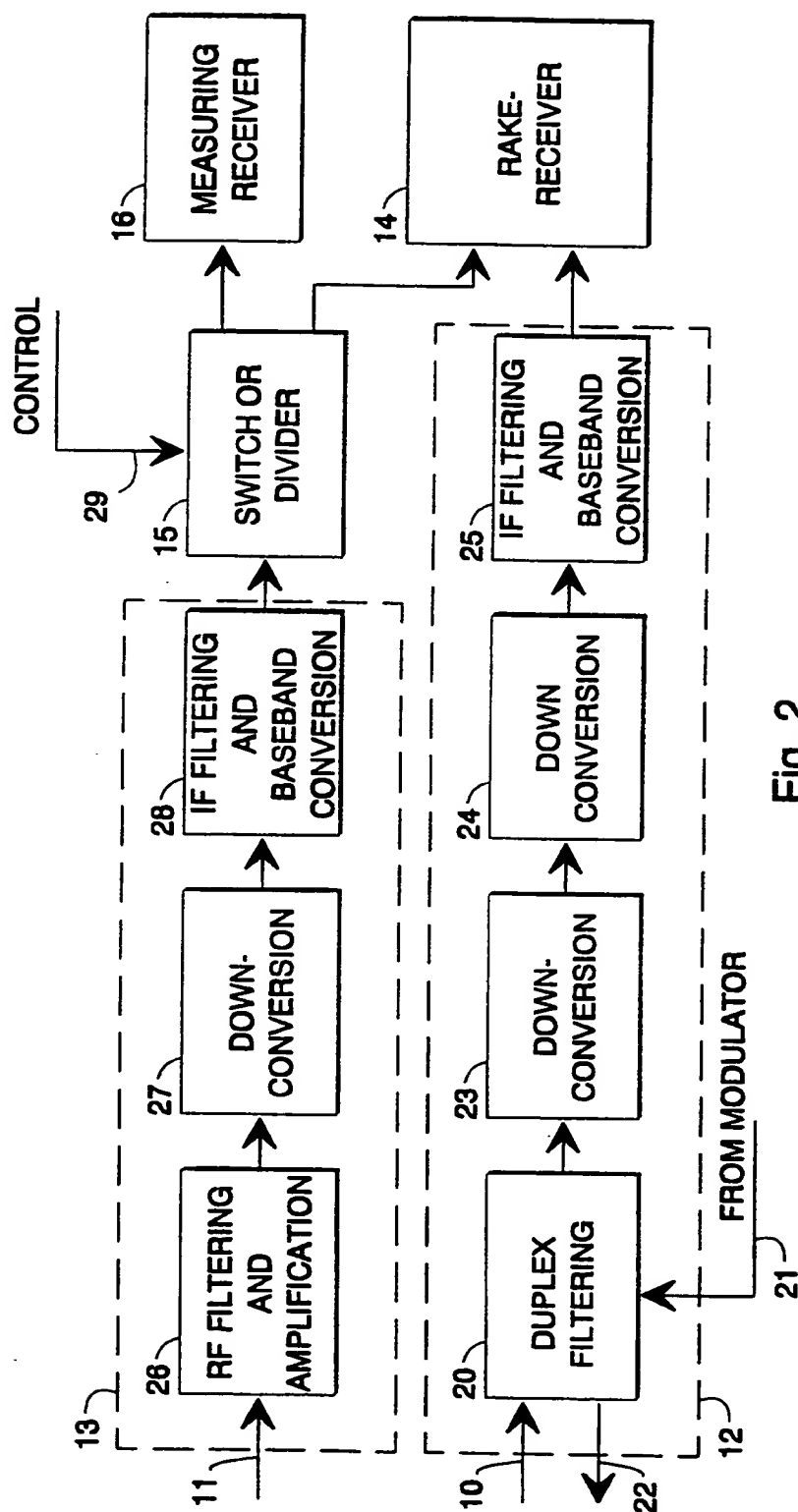


Fig. 2

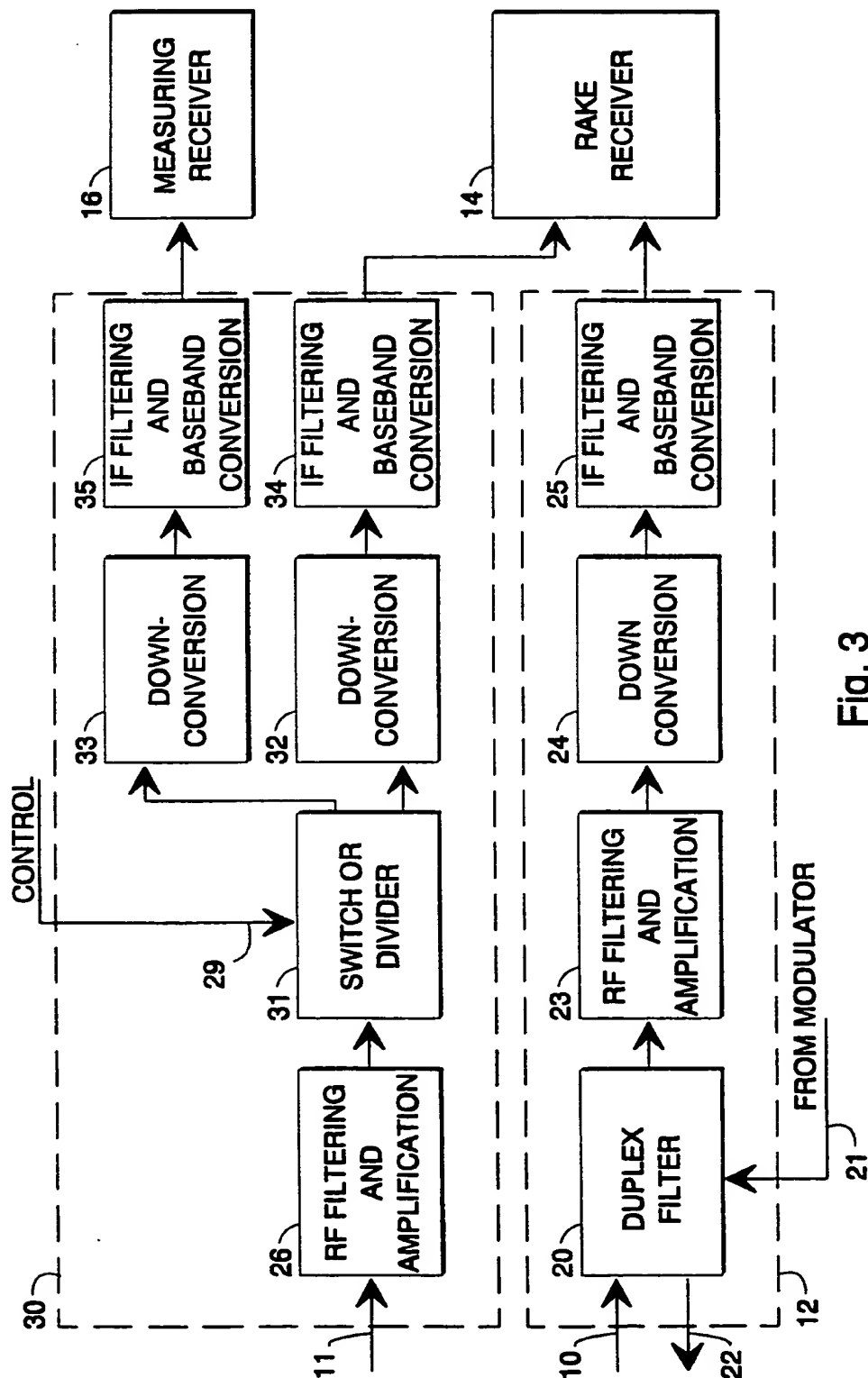


Fig. 3

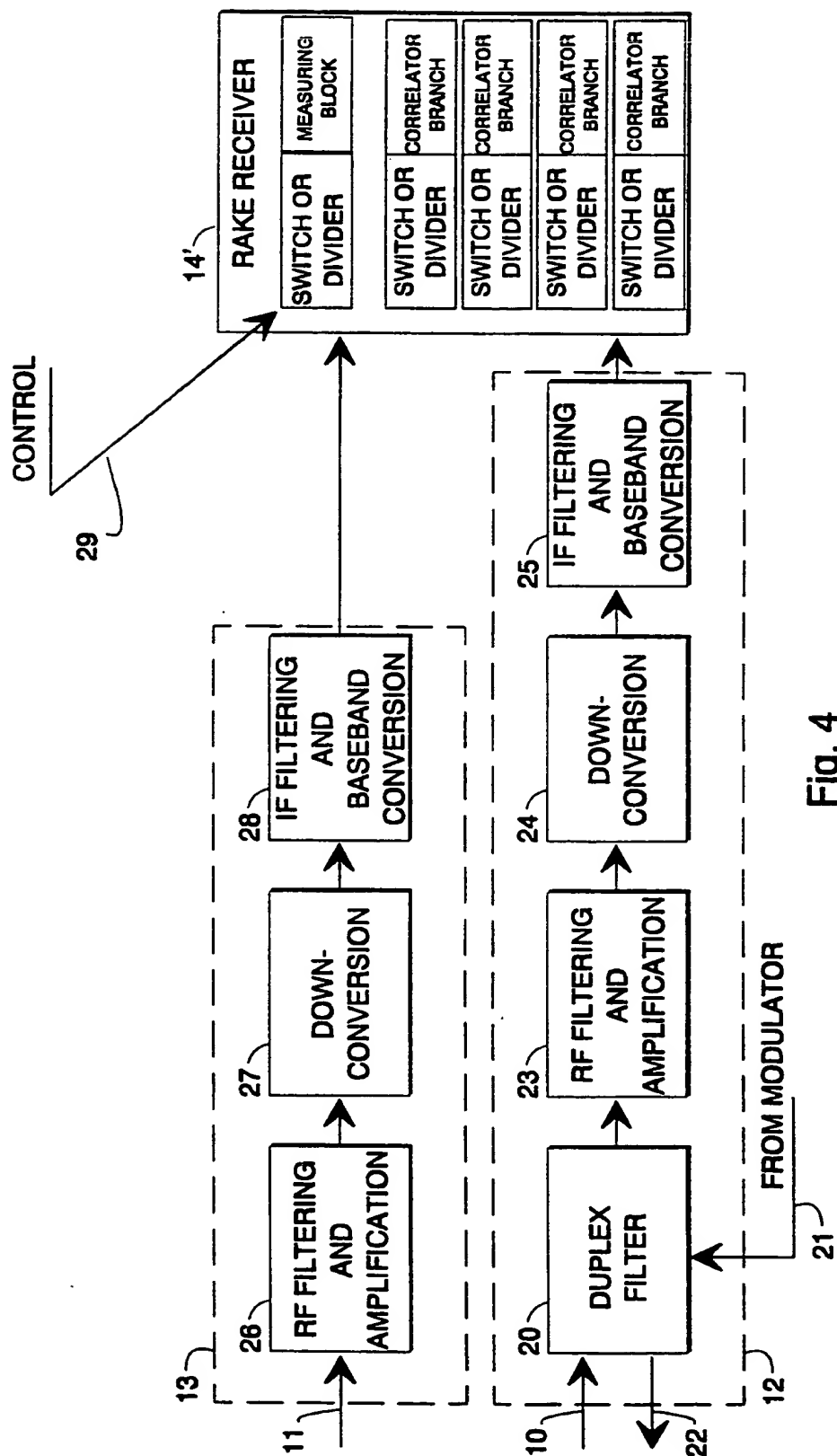


Fig. 4

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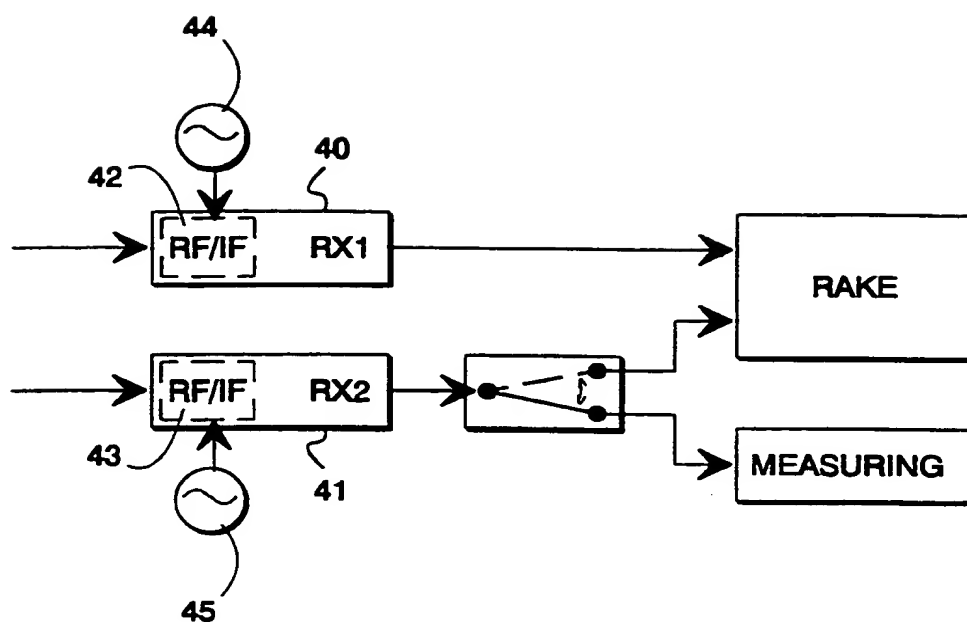


Fig. 5a

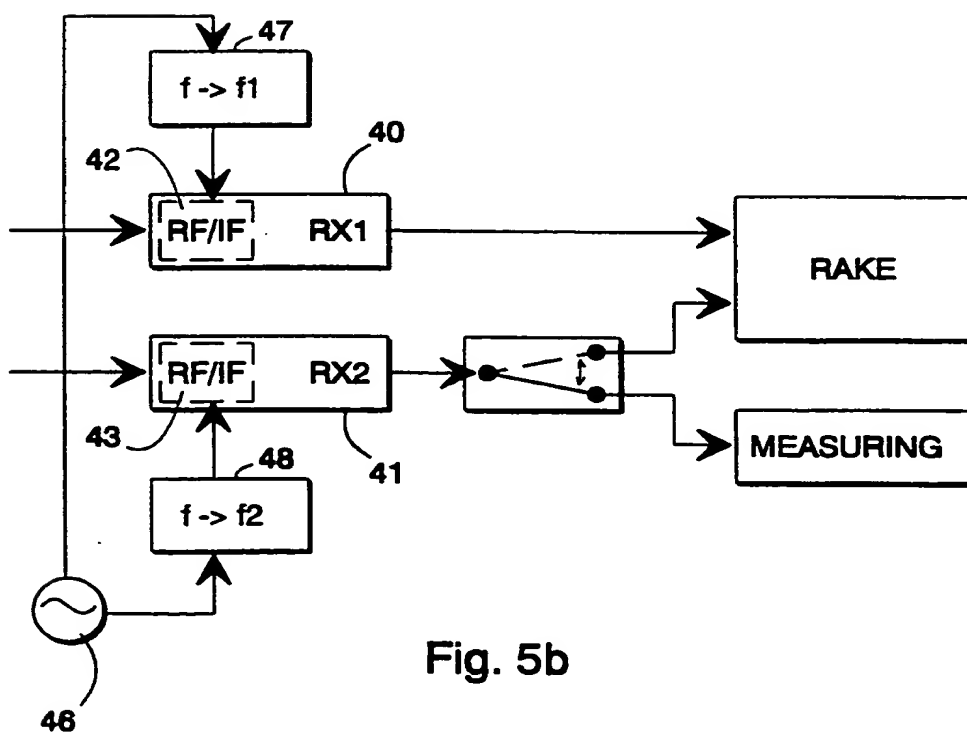


Fig. 5b

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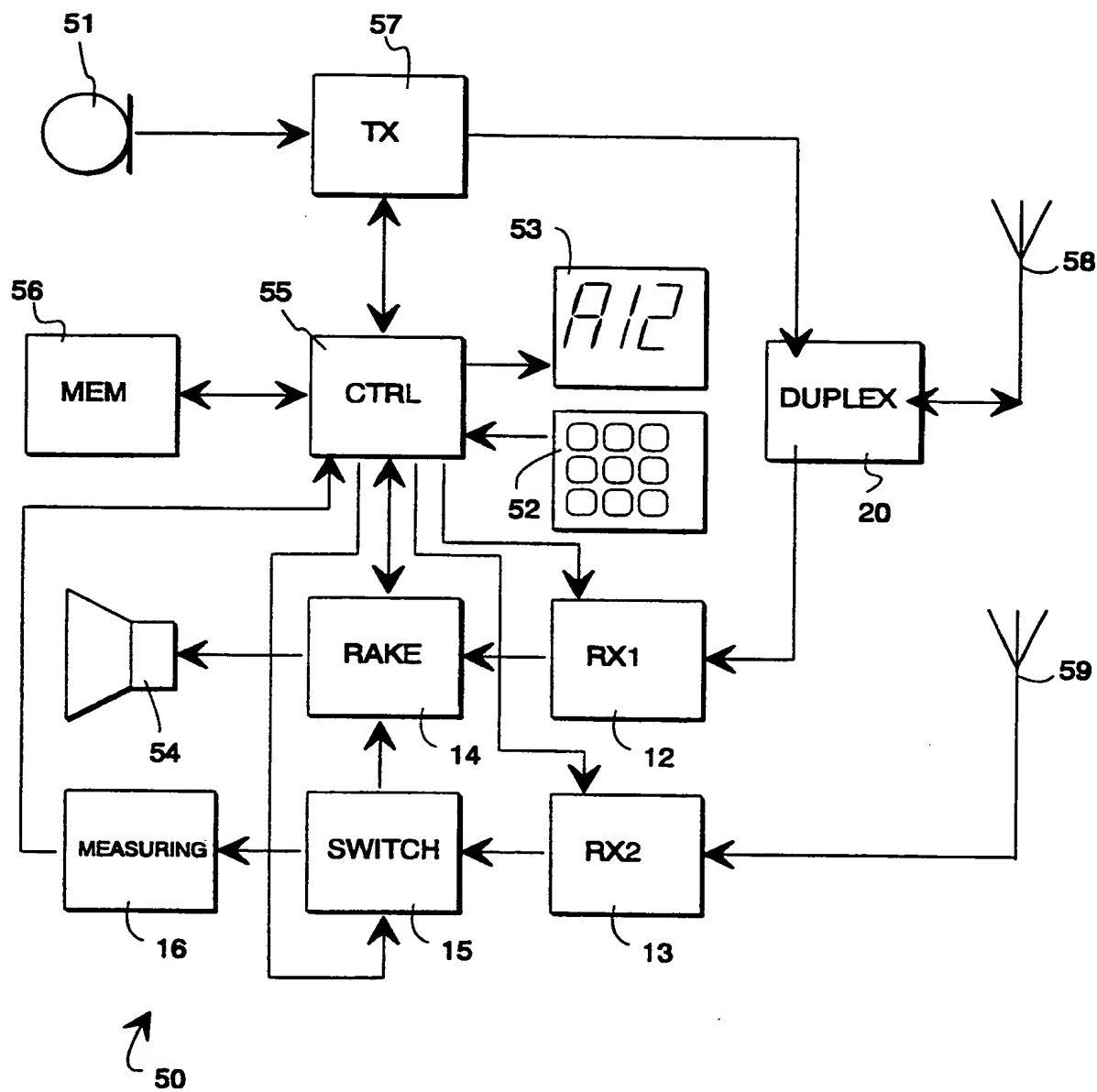


Fig. 6

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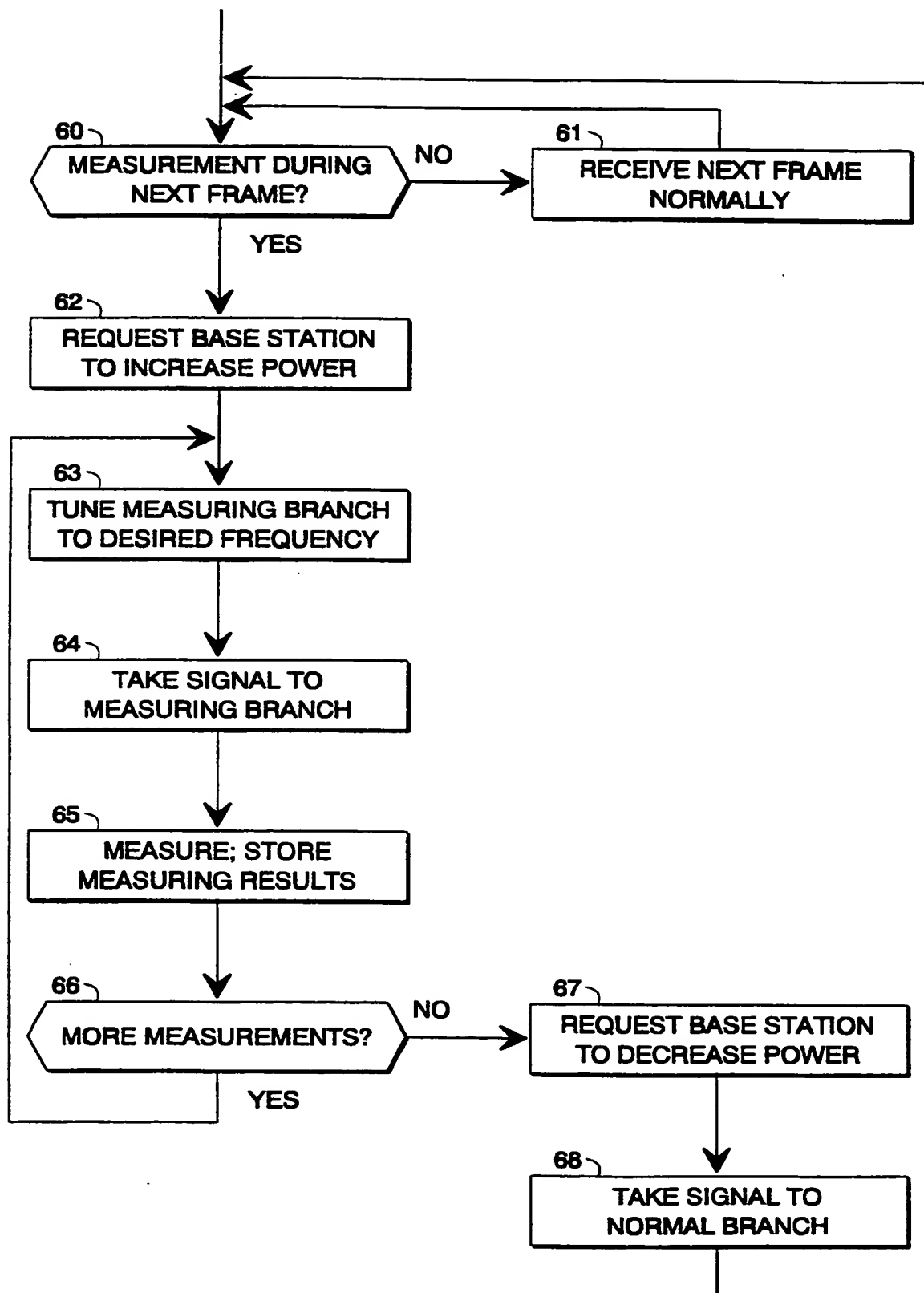


Fig. 7

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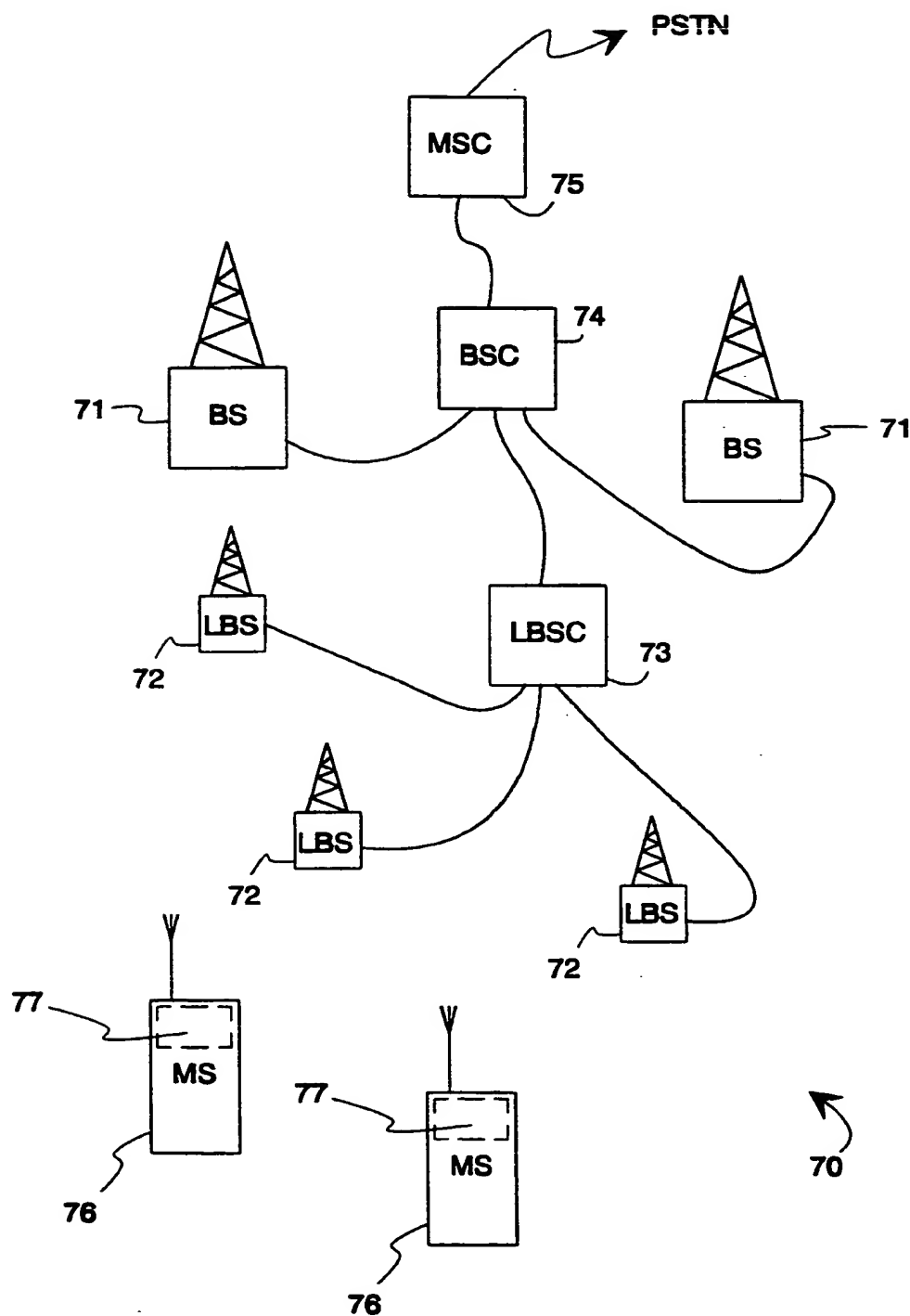


Fig. 8

The demand must be filed directly with the competent International Preliminary Examining Authority with the one chosen by the applicant. The same or two-letter code of that Authority may be indicated by the applicant on the line below:
IPEA/ _____

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only

Identification of IPEA

Date of receipt of DEMAND

Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION

Applicant's or agent's file reference
46547

International application No.

PCT/FI98/00460

International filing date (day/month/year)

(29.5.1998)
29 May 1998

(Earliest) Priority date (day/month/year)

(30.5.1997)
30 May 1997

Title of invention

Making measurements on parallel frequencies in a radio communications device

Box No. II APPLICANT(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

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State (that is, country) of residence:

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☒ Further applicants are indicated on a continuation sheet.

Continuation of Box No. II APPLICANT(S)

If none of the following sub-boxes is used, this sheet should not be included in the demand.

Name and address: *(Familyname followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

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State *(that is, country)* of residence:
Finland

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State *(that is, country)* of residence:

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State *(that is, country)* of nationality:

State *(that is, country)* of residence:

Name and address: *(Familyname followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

☐ Further applicants are indicated on another continuation sheet.

Box No. III AGENT OR COMMON REPRESENTATIVE: OR ADDRESS FOR CORRESPONDENCE

The following person is ☒ agent ☐ common representative
 and ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.
☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.
☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

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Facsimile No.:

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Teleprinter No.:

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION**Statement concerning amendments:***

1. The applicant wishes the international preliminary examination to start on the basis of:

☒ the international application as originally filed
 the description ☐ as originally filed
☐ as amended under Article 34

the claims ☐ as originally filed
☐ as amended under Article 19 (together with any accompanying statement)
☐ as amended under Article 34

the drawings ☐ as originally filed
☐ as amended under Article 34

2. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English

- ☒ which is the language in which the international application was filed.
☐ which is the language of a translation furnished for the purposes of international search.
☐ which is the language of publication of the international application.
☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

Box No. V ELECTION OF STATES

The applicant hereby elects all eligible States *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*
 excluding the following States which the applicant wishes not to elect:

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | |
|--|---|--------|
| 1. translation of international application | : | sheets |
| 2. amendments under Article 34 | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5. letter | : | sheets |
| 6. other (specify) | : | sheets |

For International Preliminary Examining Authority use only

received not received

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
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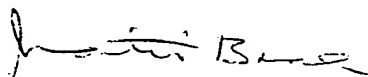
The demand is also accompanied by the item(s) marked below:

- | | |
|--|---|
| 1. <input checked="" type="checkbox"/> fee calculation sheet | 4. <input type="checkbox"/> statement explaining lack of signature |
| 2. <input type="checkbox"/> separate signed power of attorney | 5. <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form |
| 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: | 6. <input type="checkbox"/> other (specify): |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

BERGGREN OY AB



Matti Brax
Patent Agent

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.

☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 30.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 32.

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Demand received from IPEA on:

PCT

CHAPTER II

FEE CALCULATION SHEET

Annex to the Demand for international preliminary examination

International application No. PCT/FI98/00460	For International Preliminary Examining Authority use only
Applicant's or agent's file reference 46547	Date stamp of the IPEA
Applicant Nokia Mobile Phones Ltd. et al.	
Calculation of prescribed fees	
1. Preliminary examination fee	<div style="border: 1px solid black; padding: 2px; display: inline-block;">4200</div> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-left: 10px;">P</div>
2. Handling fee <i>(Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.)</i>	<div style="border: 1px solid black; padding: 2px; display: inline-block;">1250</div> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-left: 10px;">H</div>
3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box	<div style="border: 1px solid black; padding: 5px; display: inline-block;">5450</div>
<div style="border: 1px solid black; padding: 5px; display: inline-block;">TOTAL</div>	
Mode of Payment	
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<input type="checkbox"/> postal money order	<input type="checkbox"/> coupons
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Deposit Account Authorization <i>(this mode of payment may not be available at all IPEAs)</i>	
The IPEA/ _____ <input type="checkbox"/> is hereby authorized to charge the total fees indicated above to my deposit account.	
<input type="checkbox"/> <i>(this check-box may be marked only if the conditions for deposit accounts of the IPEA so permit)</i> is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.	
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Signature _____	

28 June 1999

Kungl. Patent- och registreringsverket
Valhallavägen 136
P.O. Box 5055
S-102 42 Stockholm
Sweden

Authorized Officer: Bengt Romedahl
Our ref: 46547/MB/SHU

REPLY TO WRITTEN OPINION
INTERNATIONAL PATENT APPLICATION NO. PCT/FI98/00460
APPLICANT: NOKIA MOBILE PHONES LTD.
Due Date: 10 July 1999

On account of the Written Opinion issued on 11 May 1999 we submit herewith the following:

The applicant admits that the cited reference publication discloses the use of two FM reception branches from which the signals are combined at the intermediate frequency stage. The combination of signals is associated with phase error compensation. The cited reference discloses additionally an arrangement of switches through which the other receiver branch may be coupled to measurement use so that it is additionally tuned to a different frequency.

The device according to the present invention differs from the cited reference in that the combination of signals takes place on baseband frequency. It is by no means obvious that a combination of signals on intermediate frequency could be replaced by a combination of signals on baseband frequency, because the resulting radio receiver structure is completely different. In fact, the sole use of a RAKE receiver should have served to draw a distinction between the invention and the cited reference. The RAKE receiver was recited in the original independent device claim.

The applicant has chosen to add the feature of combining the signals on baseband frequency to claim 1. Additionally the applicant has further limited the scope of claim 1 by stating that the tuning of the measurement branch to different frequencies takes place according to a certain predetermined timetable. Consequently the applicant respectfully expresses his opinion about the so amended independent device claim being patentable over cited prior art.

Regarding the independent method claim (claim 8) and the independent system claim, the applicant has added also here the feature that the tuning of the

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Managing Director
L. Nordin

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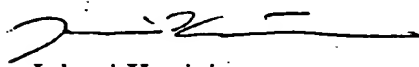
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en Propriété Industrielle
Article 30.302

2(2)

measurement receiver takes place according to a certain predetermined timetable. This feature should suffice to maintain unity of invention and to distinguish the other independent claims from cited prior art.

The applicant respectfully requests a favourable reconsideration of the invention's patentability before the issuance of the International Preliminary Examination Report.

BERGGREN OY AB



Juhani Kupiainen
 Patent Agent

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ENCL An amended set of claims

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Claims

1. A radio apparatus (50) comprising a diversity receiver which has
 - a first reception branch (12; 40) and a second reception branch (13; 41),
 - a RAKE receiver (14) comprising correlator branches (14a, 14b, 14c, 14d) for
5 combining received signal components on baseband frequency, and
 - a measuring receiver (14e; 16) for making measurements,**characterised** in that it is arranged so as to tune the first reception branch (12; 40) to a different frequency than the second reception branch (13; 41) and to make measurements of a signal produced by one reception branch simultaneously with the
10 reception of a signal produced by the other reception branch.
2. The radio apparatus of claim 1, **characterised** in that it comprises in a reception branch a switch (15; 31) which has at least two states (15a, 15b) in the first of which the switch is arranged so as to direct the signal received by said
15 reception branch to said RAKE receiver (14) and in the second of which the switch is arranged so as to direct the signal received by said reception branch to said measuring receiver (14e; 16).
3. The radio apparatus of claim 2, **characterised** in that said reception branch
20 comprises successively in the direction of the flow of the received signal
 - an RF filter and amplifier (26),
 - a first mixer (27) for IF conversion,
 - an IF filter, and
 - a second mixer (28) for baseband conversion,
25 so that said switch (15) is located after said second mixer in the direction of the flow of the received signal.
4. The radio apparatus of claim 2, **characterised** in that said reception branch comprises
30
 - an RF filter and amplifier (26),
 - a first mixer (32) for IF conversion,
 - a first IF filter (34),
 - a second mixer (34) for baseband conversion,
 - a third mixer (33) for IF conversion,

35
 - a second IF filter (35), and
 - a fourth mixer (35) for baseband conversion,

so that said switch (31) is located between said RF filter and amplifier (26) on the one hand and said first mixer (32) and third mixer (33) on the other, and it is arranged so as to

- in a first state to conduct a signal from said RF filter and amplifier (26) via said first mixer (32), first IF filter (34) and second mixer (34) to said RAKE receiver (14) and

- in a second state to conduct a signal from said RF filter and amplifier (26) via said third mixer (33), second IF filter (35) and fourth mixer (35) to said measuring receiver (16).

10

5. The radio apparatus of claim 1, **characterised** in that it comprises an oscillator (44, 45) for each reception branch (40, 41) to produce the IF mixing frequency needed for the tuning of the reception branch.

15

6. The radio apparatus of claim 1, **characterised** in that it comprises a common oscillator (46) to produce the IF mixing frequencies needed for tuning all the reception branches as well as frequency conversion means (47, 48) to convert in each reception branch the frequency produced by said common oscillator to an IF mixing frequency suitable for tuning.

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7. The radio apparatus of claim 1, **characterised** in that said RAKE receiver comprises a measuring block (14e) for measuring the impulse response of the received signals, and said measuring block can be repeatedly set so as to measure alternatively the signal produced by the first reception branch or the signal produced by the second reception branch.

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8. A method for making frequency specific measurements in a diversity receiver which comprises at least two reception branches and which receives at a certain operating frequency, in which method to make measurements at other than the operating frequency, at least one reception branch is tuned (63) to other than the operating frequency and the signal received by it is directed (64) to a measuring receiver, **characterised** in that the tuning of at least one branch of the diversity receiver to other than the operating frequency is timed according to a certain predetermined timetable which is known to the transmitter apparatus transmitting at the operating frequency.

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9. The method of claim 8, **characterised** in that a transmitter apparatus transmitting at the operating frequency is also requested (62) to transmit at a higher

power during the time that at least one branch of the diversity receiver is tuned to other than the operating frequency.

- 5 10. The method of claim 9, **characterised** in that a request for transmitting at a higher power is transmitted to said transmitter apparatus at a moment of time which is earlier by a certain delay length than the commencement of making the measurements at other than the operating frequency, said delay length corresponding to the previously estimated delay between a transmitted request for changing transmission power and the arrival at the receiver of the first transmission with the transmission power changed as per the request.
- 10 11. The method of claim 9, **characterised** in that a request for transmitting at a lower power is transmitted to said transmitter apparatus at a moment of time which is earlier by a certain delay length than the end of making the measurements at other than the operating frequency, said delay length corresponding to the previously estimated delay between a transmitted request for changing transmission power and the arrival at the receiver of the first transmission with the transmission power changed as per the request.
- 15 12. The method of claim 8, **characterised** in that said transmitter apparatus has various timetables concerning various terminals or groups of terminals.
- 20 13. The method of claim 8, **characterised** in that bit errors that occur in the reception while at least one branch of the diversity receiver is tuned to other than the operating frequency are corrected using interleaving in the signal received at the operating frequency.
- 25 14. The method of claim 8, **characterised** in that the tuning of at least one branch of the diversity receiver to other than the operating frequency is timed according to a timetable determined by the diversity receiver, the interval in the timetable between consecutive tunings of at least one branch of the diversity receiver to other than the operating frequency being inversely proportional to the relative received power, proportional to the received power at the operating frequency, on some or several other carriers.
- 30 15. A method for making frequency specific measurements in a diversity receiver which comprises at least two reception branches and a RAKE receiver including correlator branches and which receives at a certain operating frequency,
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characterised in that to make measurements at other than the operating frequency, an impulse response measurement at the operating frequency carried out by a measuring block in the RAKE receiver is interrupted and said measuring block is set to carry out a measurement at other than the operating frequency.

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16. A communications system (70) comprising base stations (71, 72) and terminals (76) of which at least one comprises a diversity receiver (77) which has at least two reception branches and a RAKE receiver including correlator branches to combine signals received by the different reception branches and which also has a measuring receiver to make measurements, characterised in that at least one terminal is arranged so as to tune the first reception branch (12; 40) to other frequencies than the second reception branch (13; 41) and to make measurements of both the signal produced by the first reception branch and the signal produced by the second reception branch, and the tuning of said first reception branch to other frequencies is timed according to a certain predetermined timetable which is known to at least one base station.

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